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GENERATING MULTI-SCROLL CHAOTIC ATTRACTORS VIA A LINEAR SECOND-ORDER HYSTERESIS SYSTEM

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Abstract. This paper introduces a new method for generating multi-scroll chaotic attractors using a linear second-order hysteresis system. It includes 1-D $n-$scroll and 2-D $n \times m-$grid scroll chaotic attractors. Basic dynamical behaviors of the hysteresis chaotic systems are further investigated via theoretical analysis. Especially, the chaotic behaviors are verified theoretically. Finally, the chaos generators are experimentally confirmed via a novel circuit design.

Keywords. Chaos generation, hysteresis series, multi-scroll chaotic attractor, circuit design
AMS (MOS) subject classification:34C28, 34H05, 94C15, 94B99

1 Introduction

Recently, there has been increasing interest in exploiting chaotic dynamics for engineering applications, in which much attention has focused on effectively generating chaos from simple systems by simple controller design techniques. In fact, strange attractors could be found in a simple system, for example in a 1D continuous-time linear autonomous system with delay in a piecewise-linear feedback function [1], or in a delay cellular neural network composing of only two cells [2].

Today, generating multi-scroll chaotic attractors is not a very difficult task, and there are some successful results reported in the literature [3-13]. Elwakil and Kennedy constructed a class of circuit-independent chaotic oscillators [3-5]. Suykens and his colleagues proposed some methods for generating n-scroll attractors with simple circuits [6-8]. In [7], they suggested a simple model for generating even more complicated n-scroll chaotic attractors with a circuit realization, and reported a family of grid-scroll attractors [8]. Along the same line, Tang and his colleagues also designed some simple sine-function circuits to generate multi-scroll chaotic attractors, with circuit